

## Abstract

Intercalibrating GPM constellation satellites is of fundamental importance to diagnose instrumental performance and integrate data [1-4]. We investigated GMI intercalibration variability. This poster presents results intercalibrating WindSat with GMI over ocean (cold intercalibration point), but the main conclusions hold for intercalibration with other constellation radiometers.

We discovered a pronounced signal in intercalibration with ~40-day period. This signal is found to relate to the variability of GMI/WindSat colocations. Geophysical parameters, including water vapor, surface wind speed (WS), and sea surface temperature (SST), vary accordingly with this variability propagating into intercalibration. The dependence of intercalibration on geophysics is observed not only with high values of parameters (e.g., high water vapor, wind speed) but also in the calm conditions that are used to determine TB offsets with respect to GMI for producing Level 1C data. This implies issues with model parameterization and ancillary data that don't cancel with double differencing when radiometer frequencies and incidence angles differ.

Future work will focus on reducing these issues and on quantifying residual uncertainties (putting error bars on intercalibration).

## Temporal Variability

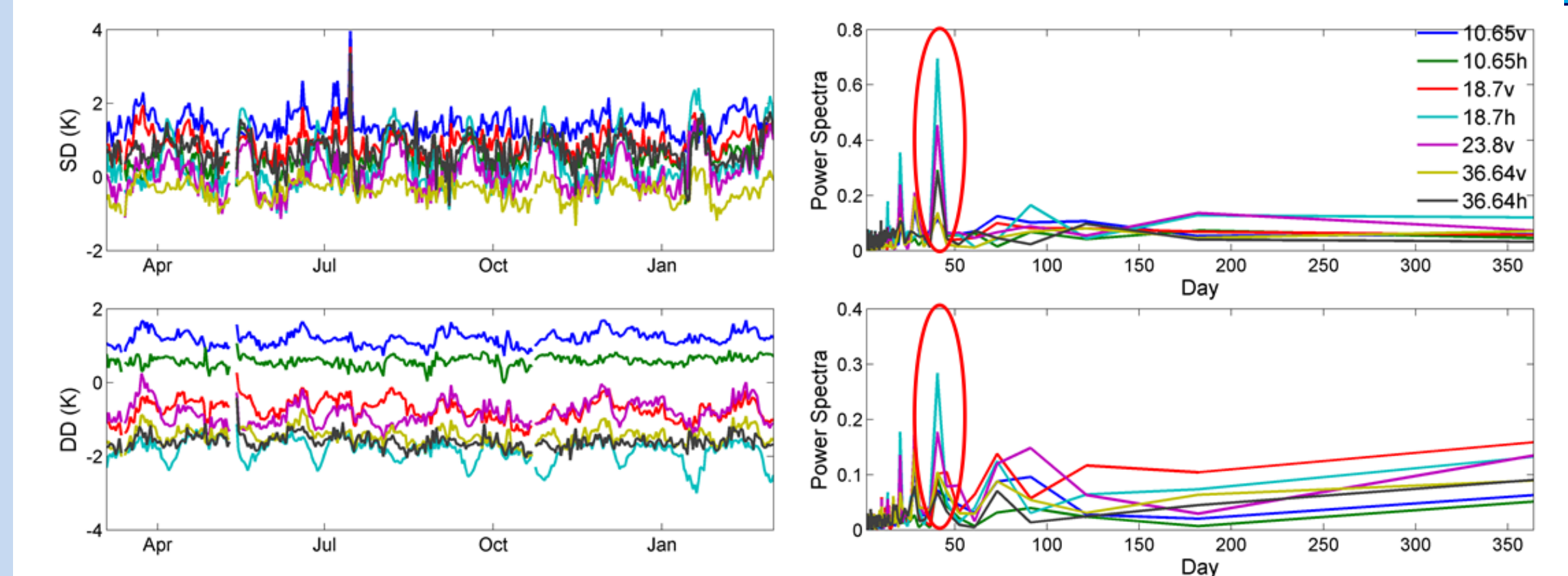


Figure 1. Time series of single and double differences and corresponding power spectra. A signal with a ~40-day period is discovered in both due to the shifting of the GMI orbit (low inclination) with respect to the WindSat orbit (sun-synch).

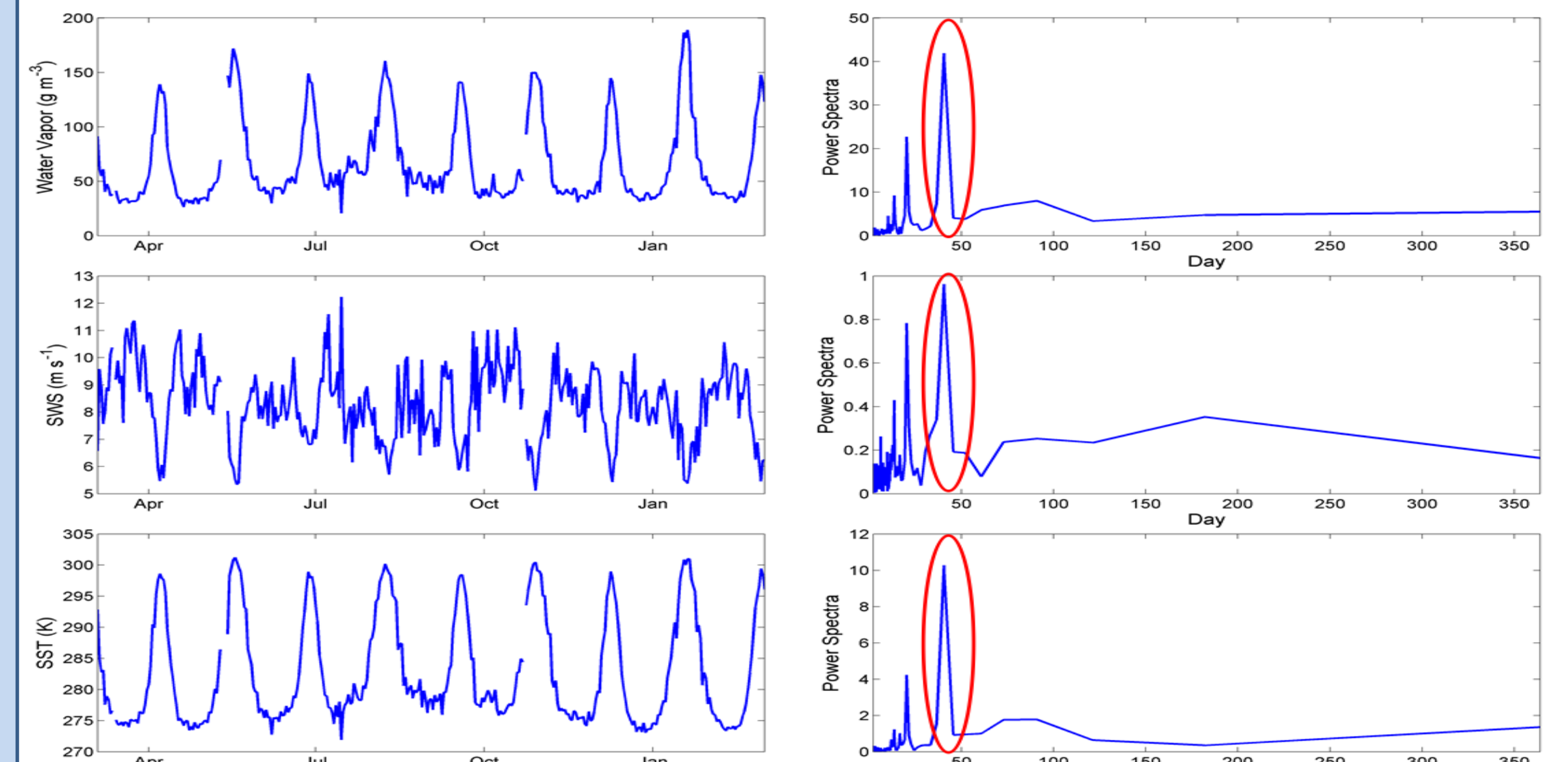


Figure 2. The same as Figure 1, but for geophysical parameters including water vapor, WS, and SST. The 40-day signal is also found.

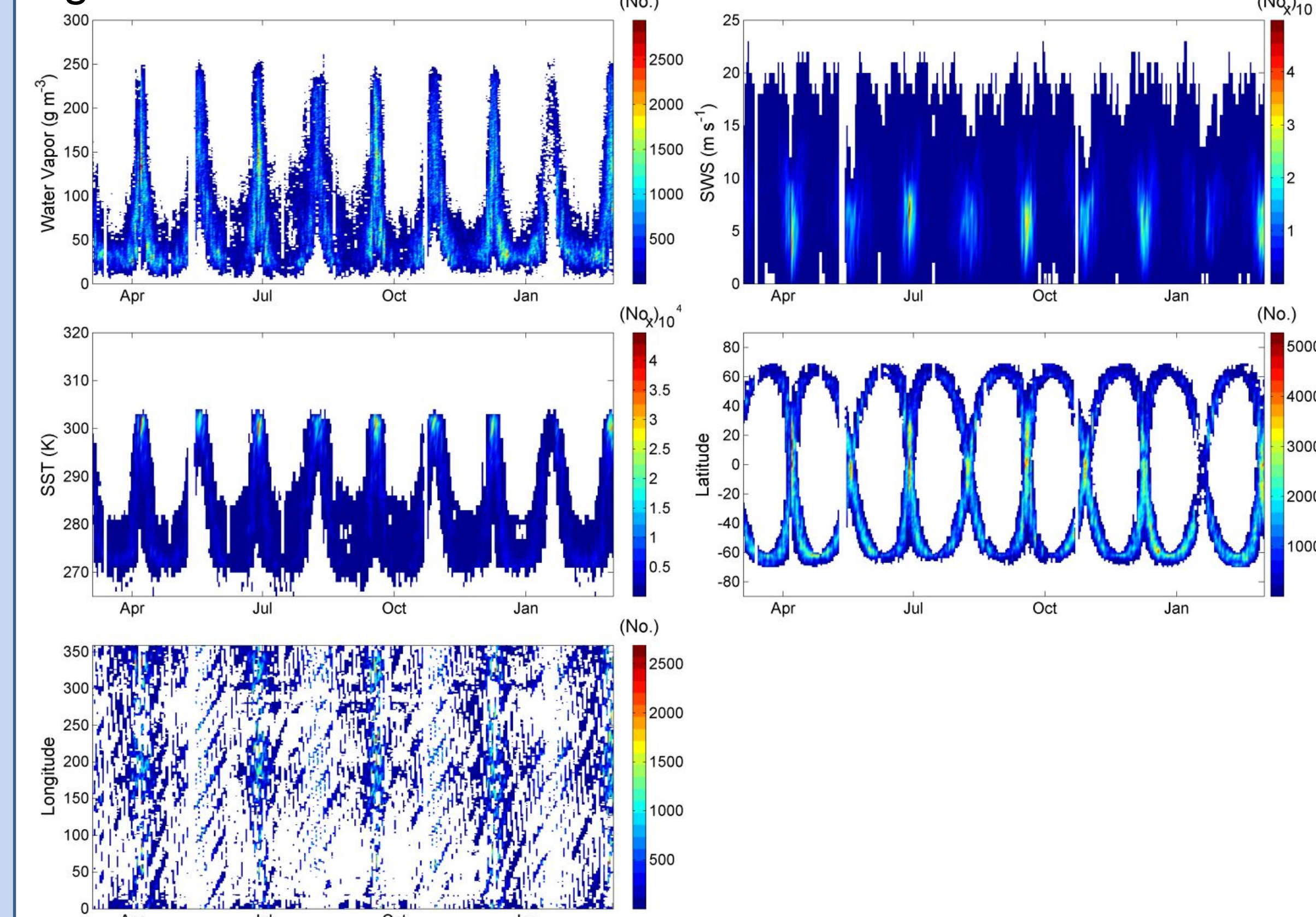


Figure 3. The temporal variability of a number of parameters, including water vapor, WS, SST, and intercalibration location (location of GMI/WindSat crossovers/colocations).

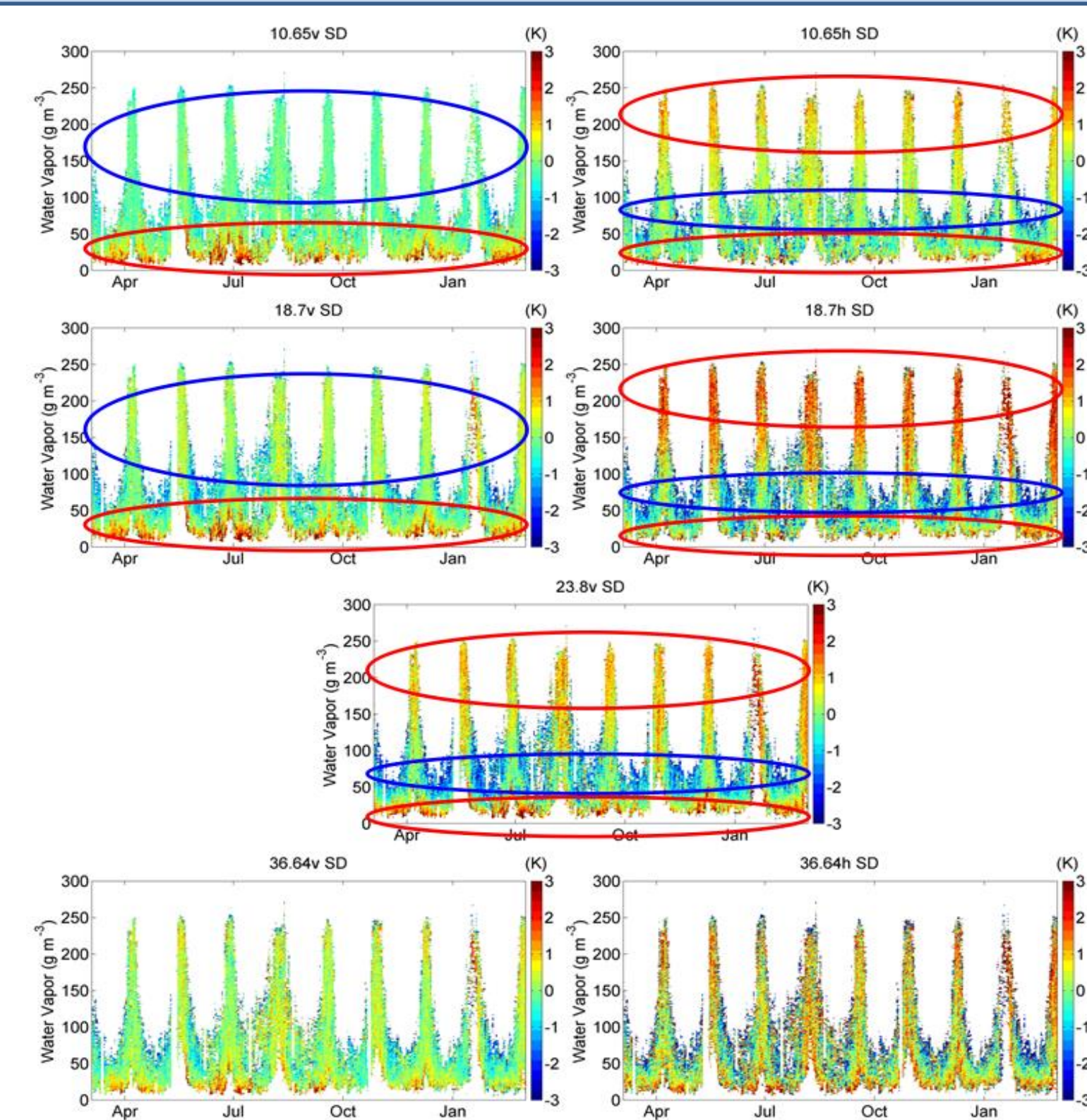


Figure 4. Temporal variability of single differences (obs-sim) as a function of water vapor. The positive and negative departures are highlighted, showing different types of dependence as a function of channel.

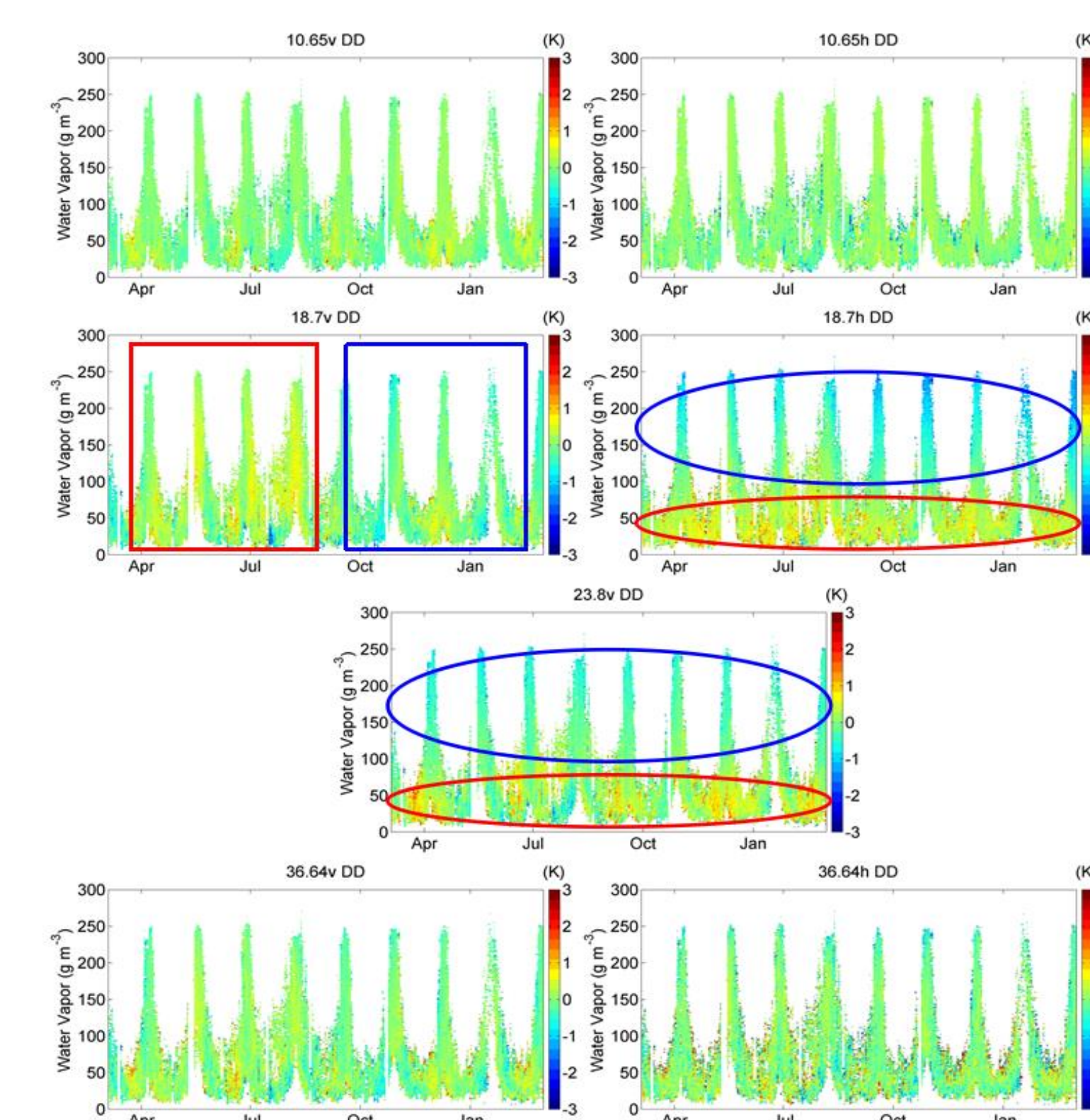


Figure 5. The same as Figure 4, but for double difference ((obs-sim)<sub>GMI</sub> - (obs - sim)<sub>WindSat</sub>).

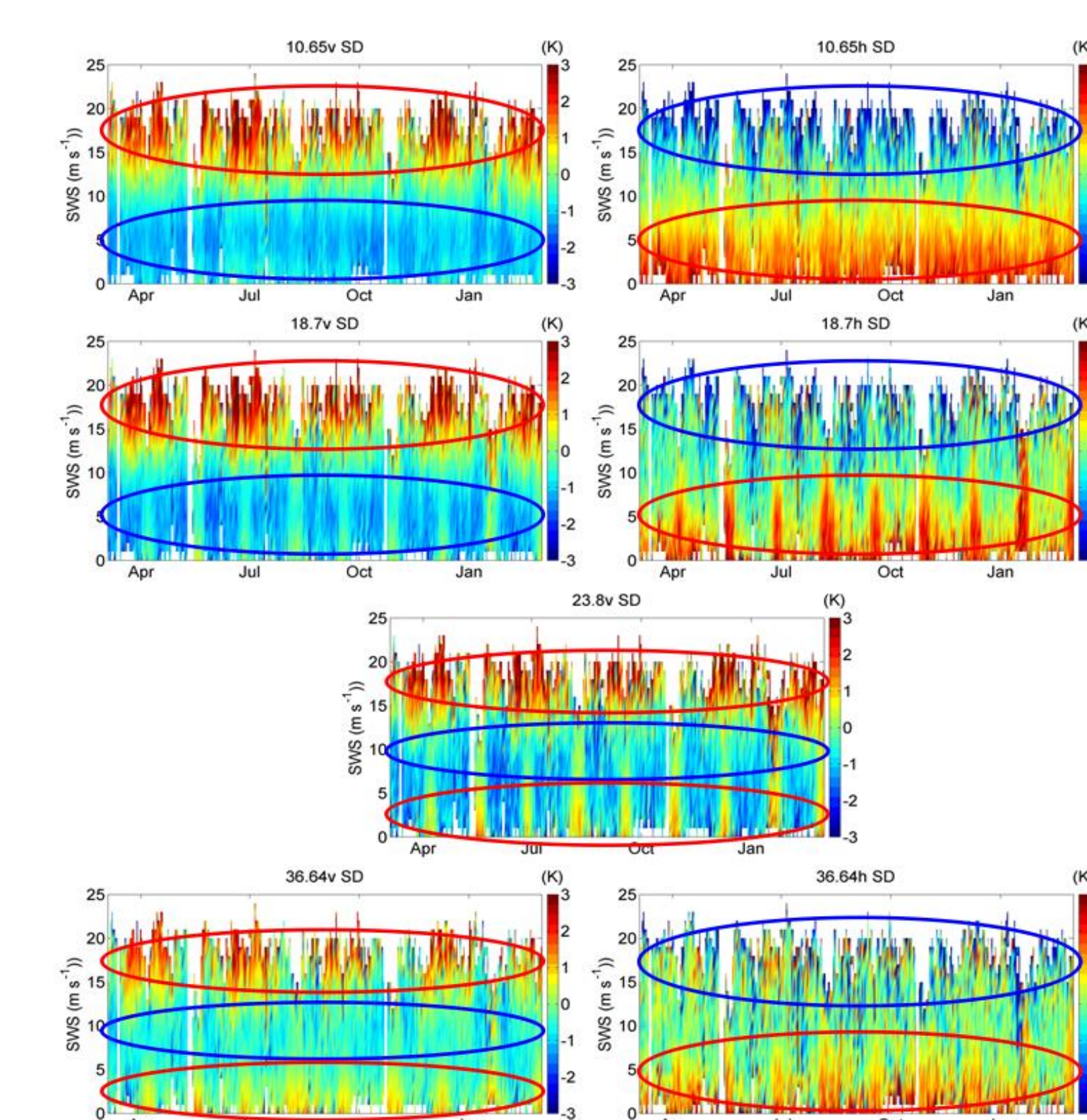


Figure 6. The temporal variability of single difference as a function of WS. Highlighted positive or negative departures vary as a function of channel.

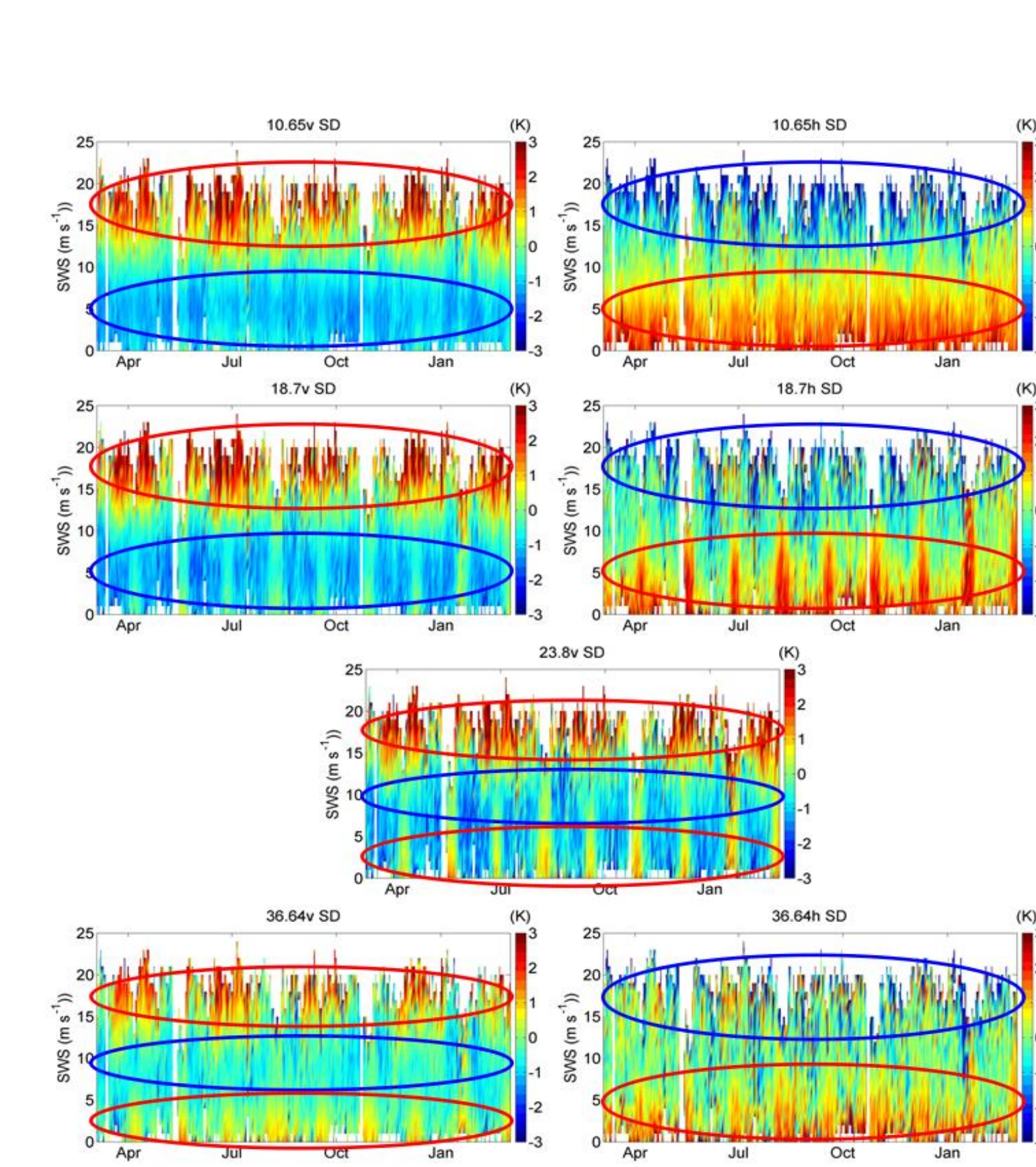


Figure 7. The same as Figure 6, but for double difference.

Channel	WindSat Frequency (GHz)	WindSat EIA (deg)	GMI Frequency (GHz)	GMI EIA (deg)
10.7	10.7	50.1	10.65	52.8
18.7	18.7	55.6	18.7	52.8
23.8	23.8	53.2	23.8	52.8
37	37.0	53.2	36.5	52.8

Table 1. Comparison of intercalibrated WindSat and GMI channels. Double differences don't entirely cancel out simulation inaccuracies likely due to frequency and Earth incidence angle (EIA) parameterization issues together with geophysical parameter inaccuracies and non-linearity.

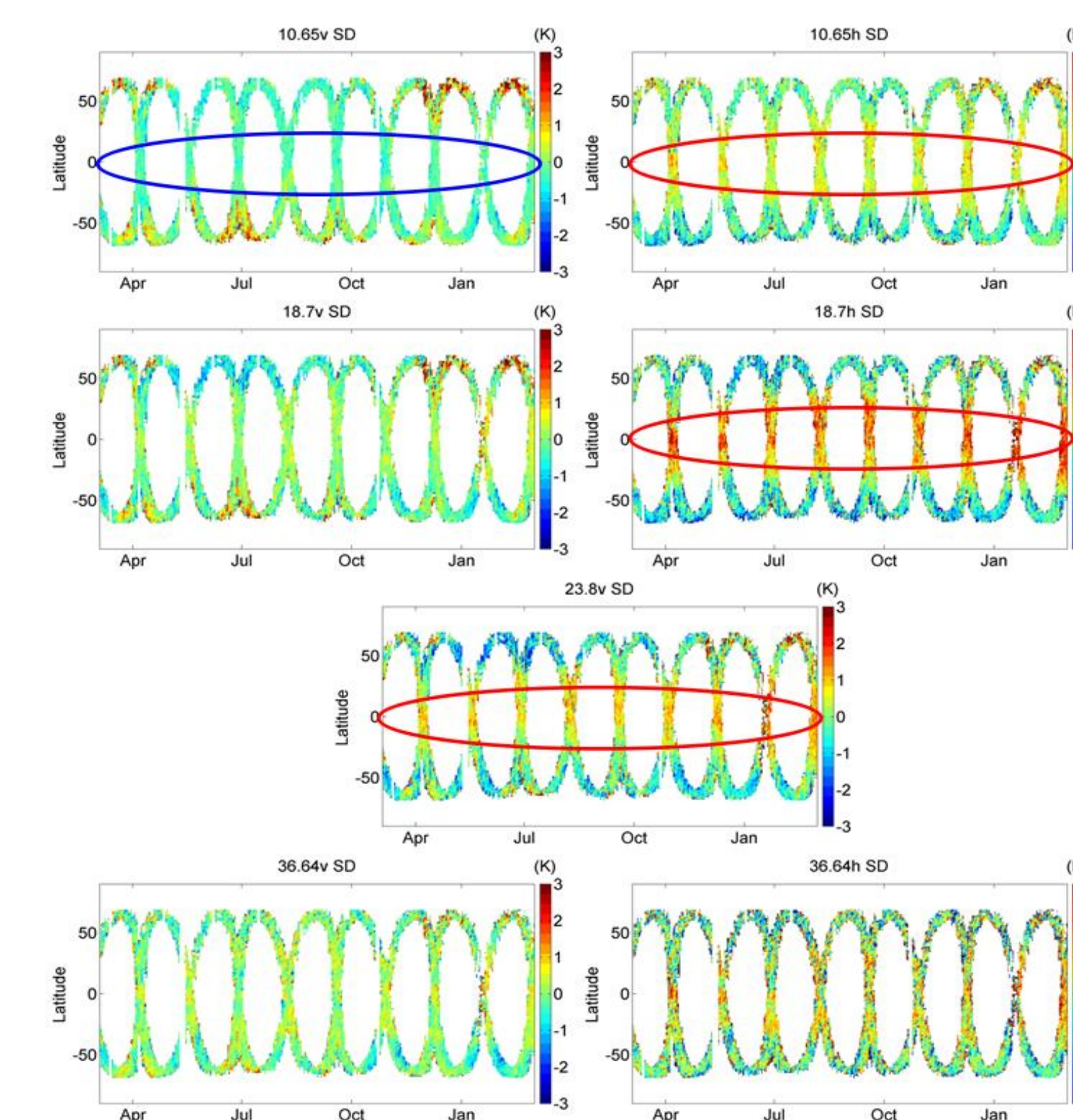


Figure 8. Maps of single differences for GMI/WindSat colocations as a function of time for each channel.

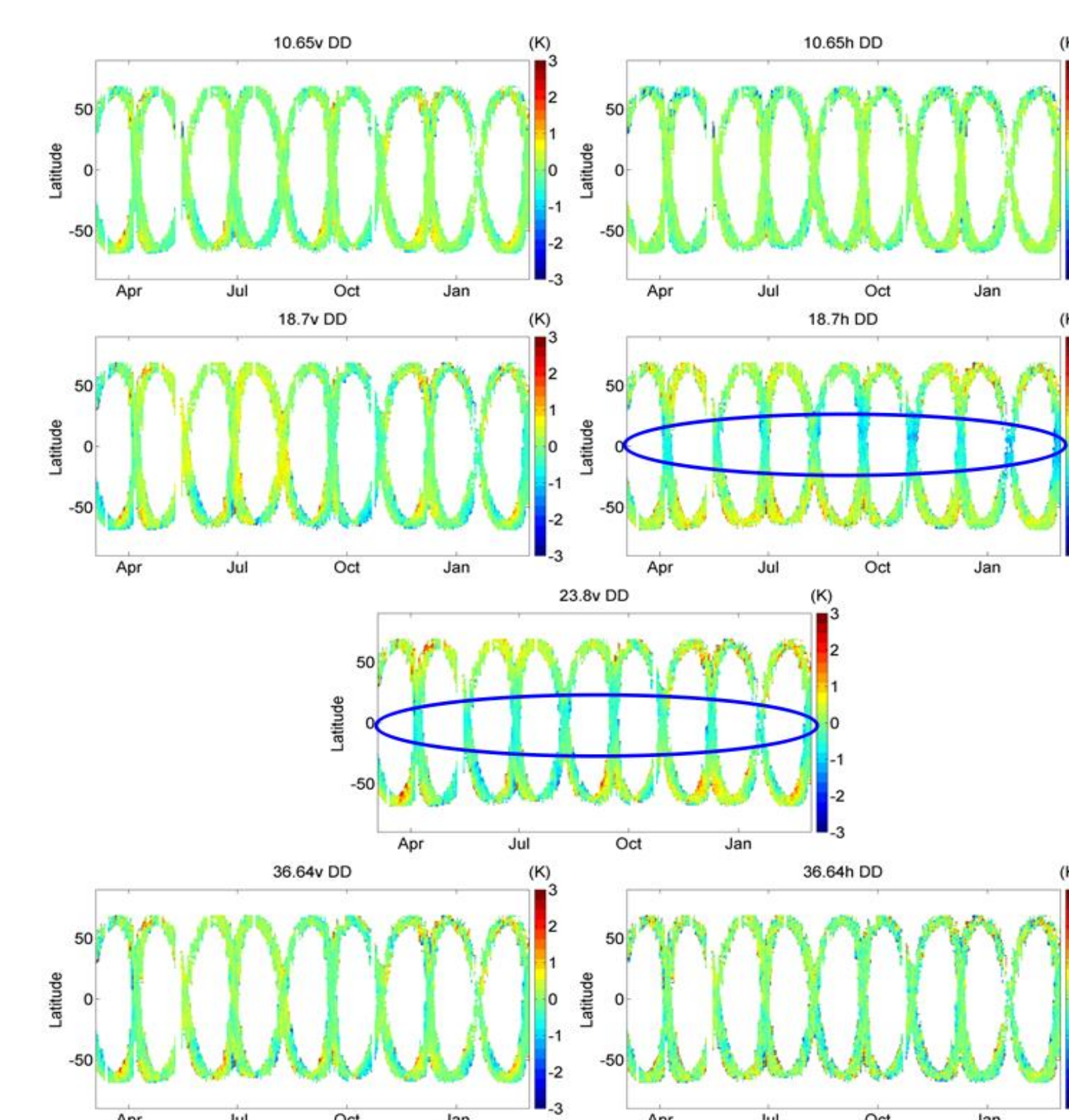


Figure 9. The same as Figure 8, but for double differences.

## Spatial Variability

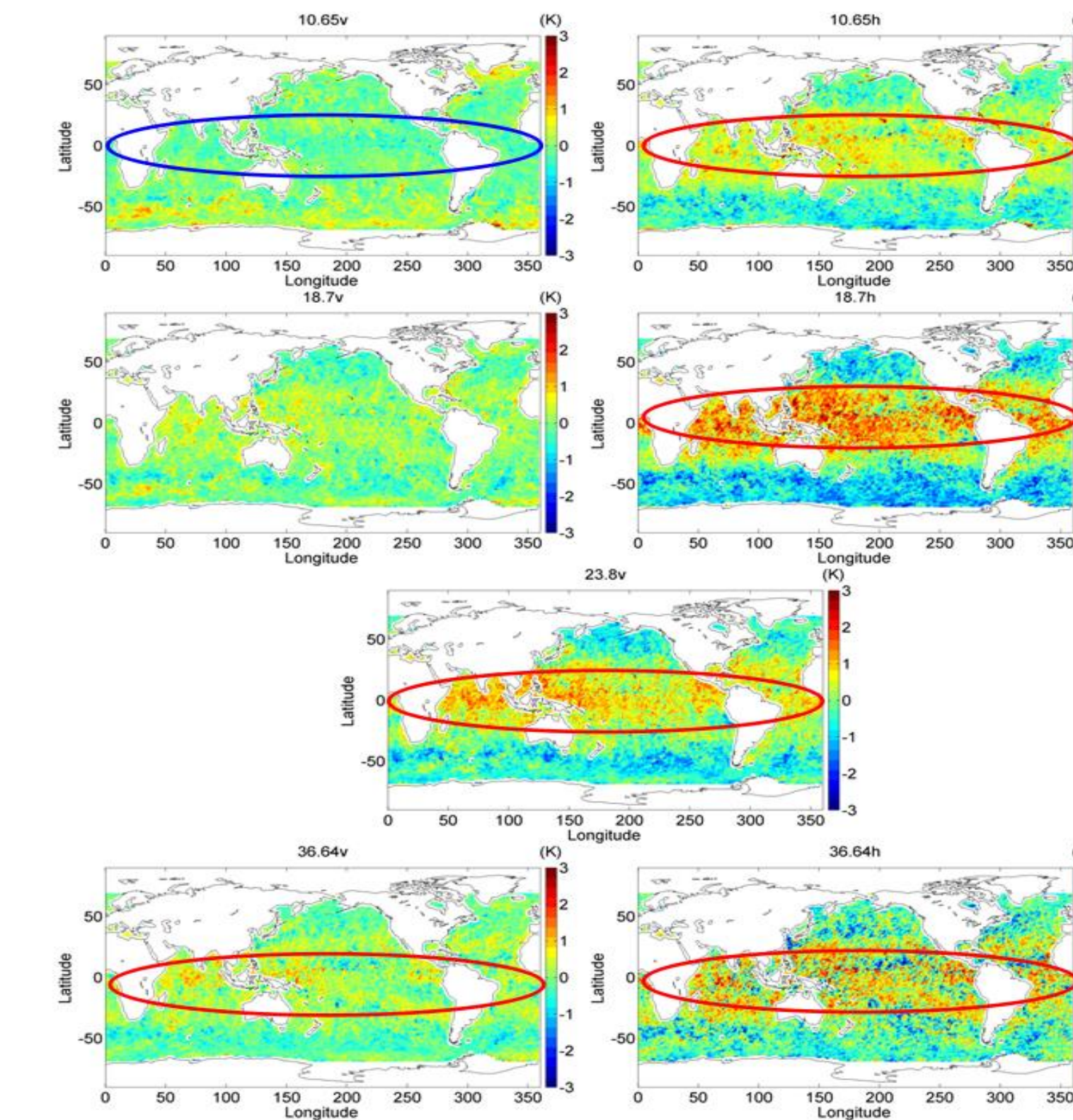


Figure 10. Maps of single differences for each channel. The positive and negative departures are highlighted, showing regional dependences.

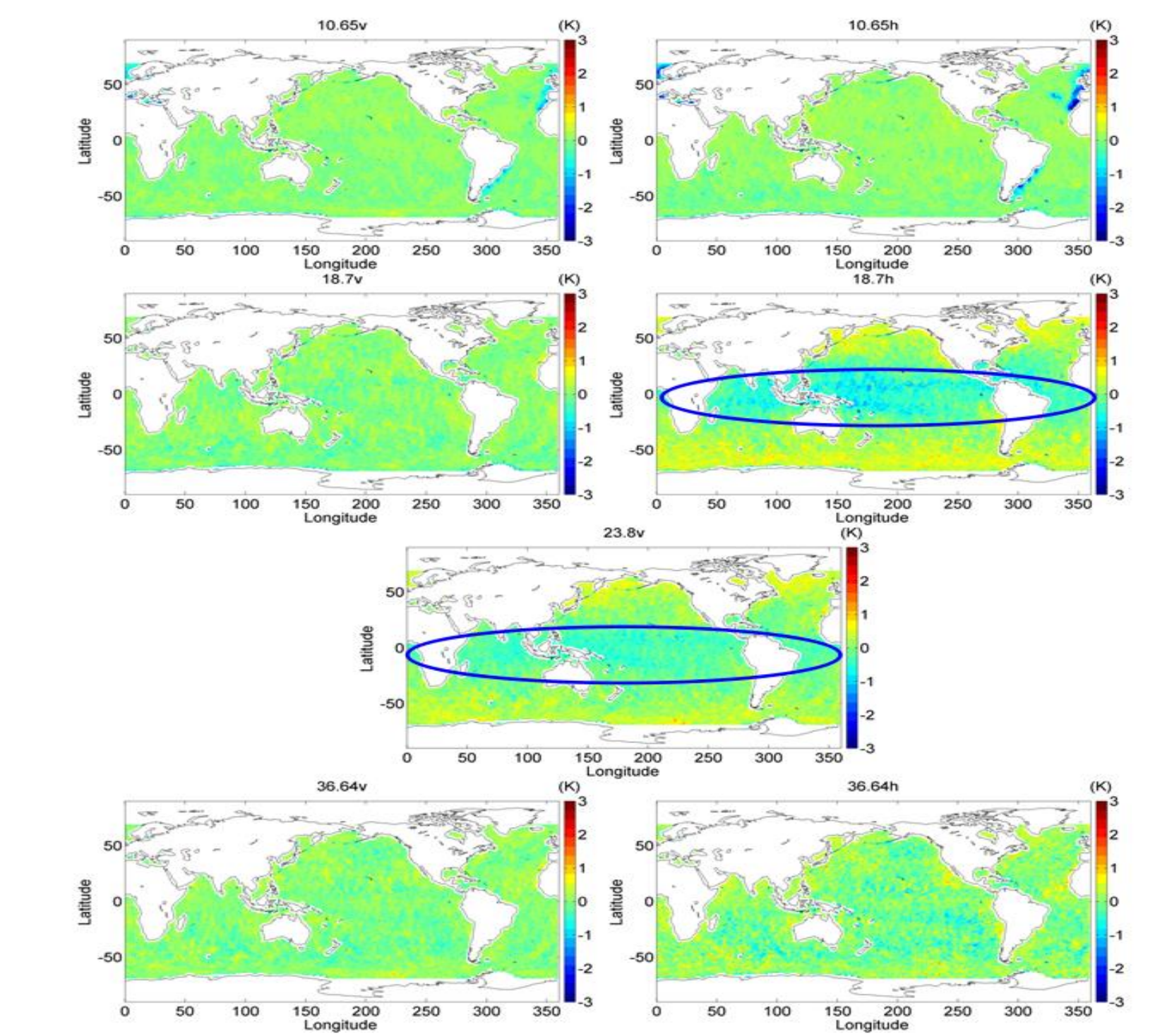


Figure 11. The same as Figure 10, but for double differences.

## Dependence on TB

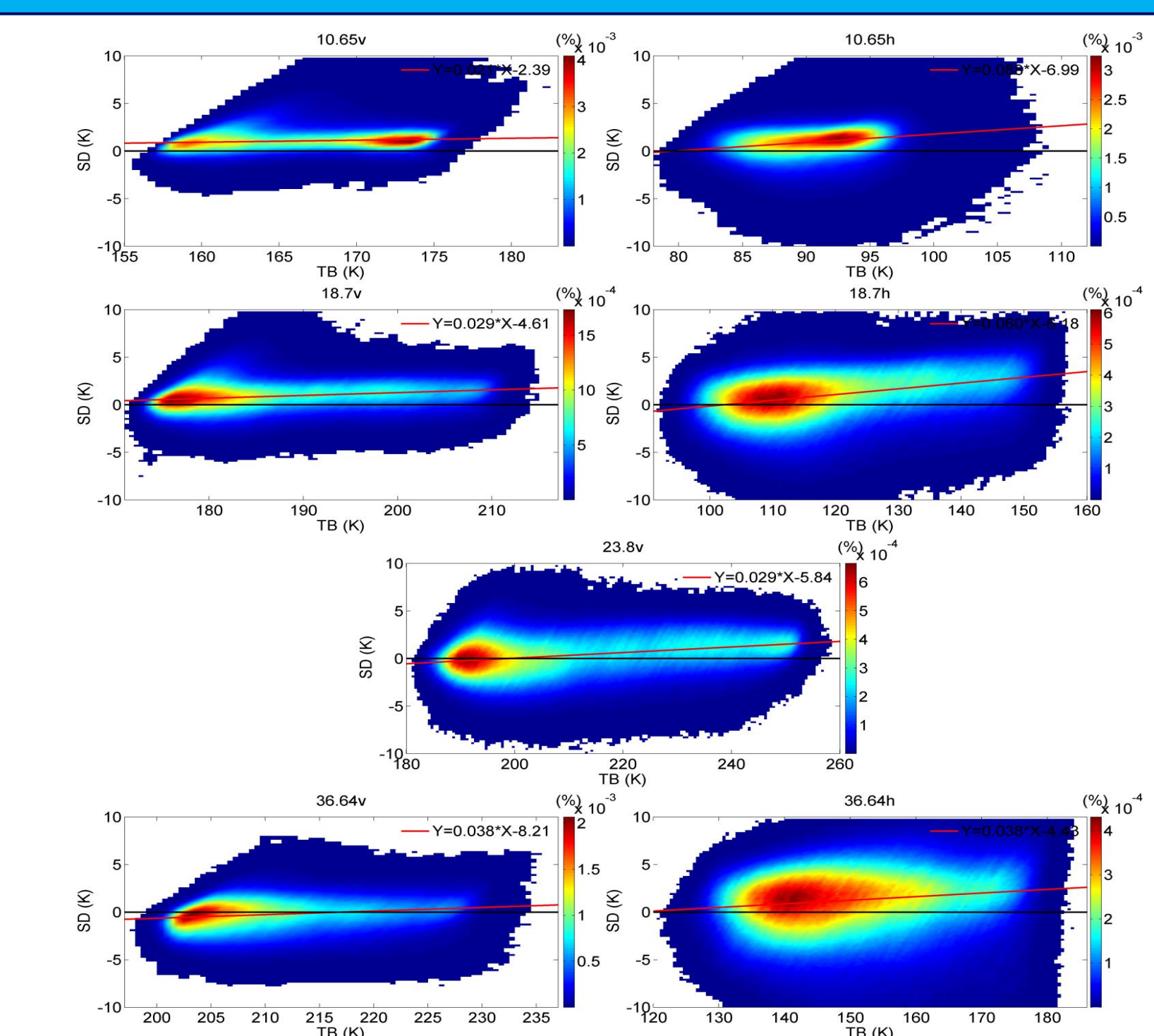


Figure 12. The single differences as a function of TB.

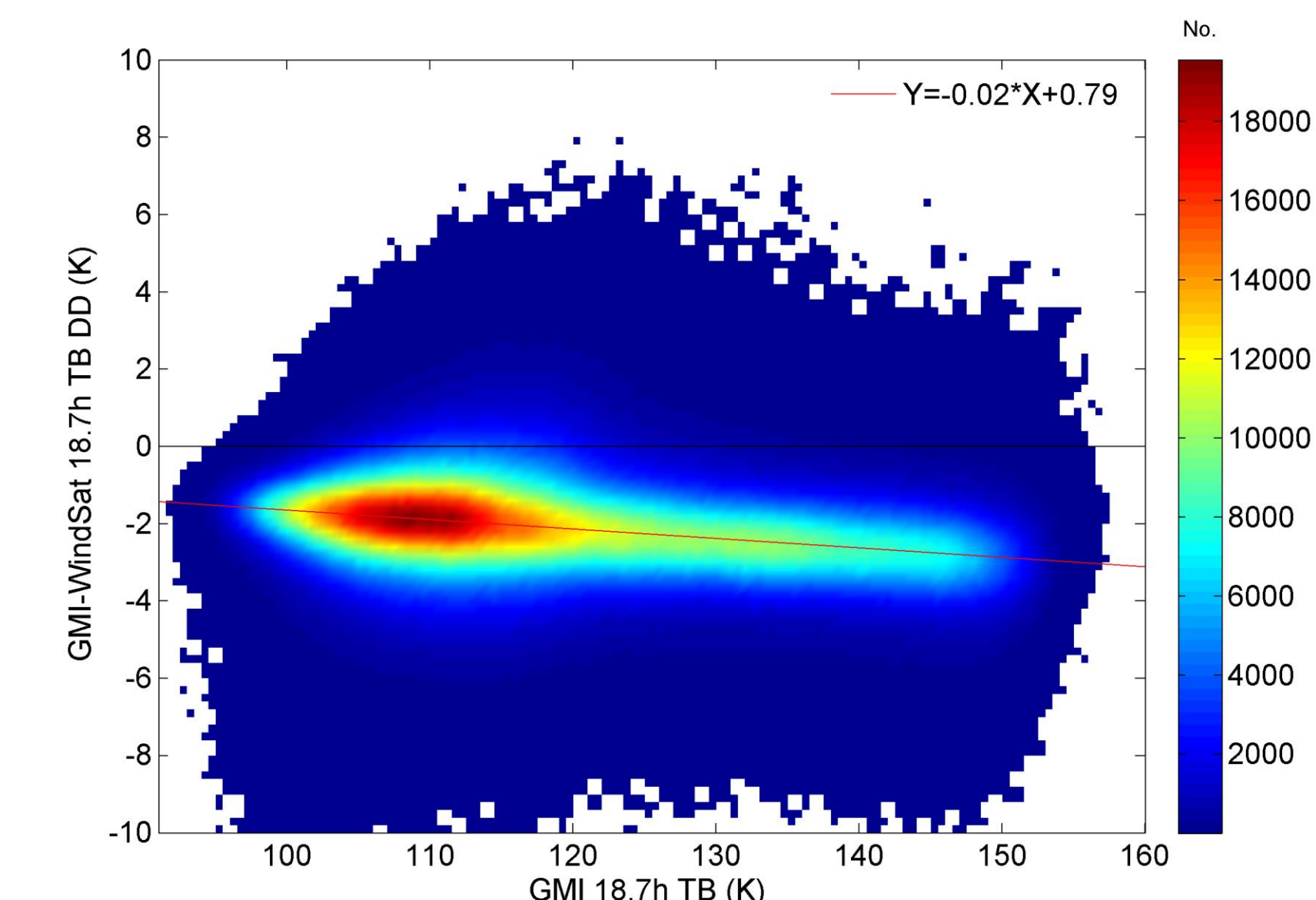


Figure 13. 18.7H double difference as a function of TB. If extrapolated to 280 K (temperature of warm intercalibration over forests), the trend shown predicts a double difference of -4.8 K. Warm intercalibration results for this channel show a double difference of around -0.6 K.

## References

- [1] Yang J. X., D. S. McKague, and C. S. Ruf, "Land Contamination Correction for Passive Microwave Radiometer Data: Demonstration of Wind Retrieval in the Great Lakes Using SSM/I," Journal of Atmospheric and Oceanic Technology, vol. 31, pp. 2094-2113, Oct 2014.
- [2] Yang J. X., D. S. McKague, and C. S. Ruf, "Identifying and resolving a calibration issue with GMI," 2015 IEEE International Geoscience and Remote Sensing Symposium (IGARSS), selected into ten finalists in Student Paper Contest), 2015.
- [3] Yang J. X., D. S. McKague, and C. S. Ruf, "Boreal, Temperate, and Tropical Forests as Vicarious Calibration Sites for Spaceborne Microwave Radiometry," IEEE Transactions on Geoscience and Remote Sensing, submitted, 2015.
- [4] Yang J. X., D. S. McKague, and C. S. Ruf, "Characterizing Radiometry Intercalibration Variability and Dependence on Geophysical Parameters," IEEE Transactions on Geoscience and Remote Sensing, submitted, 2015.